

PATENT SPECIFICATION



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COMPLETE SPECIFICATION

A Process and Apparatus for the Manufacture by Rolling of Annular Articles, especially Ball-bearing Race Rings and the like

We, THE HOFFMANN MANUFACTURING COMPANY LIMITED, a British Company, of Chelmsford, Essex, Assignees of FRIEDRICH IM SCHLAA, German Citizen, of Iserlohn (Westphalia), Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The known methods of producing annular articles comprise pressing, forging and rolling. It has not hitherto been possible, by rolling, to produce on the peripheral surfaces of the articles annular formations of a more than comparatively superficial nature without thereby enlarging the bore of the article. For this reason it was not possible to roll ball races, for example the running tracks of the inner race rings of ball bearings, without at the same time increasing the diameter of the bore. It is an object of the invention to provide a rolling process by which this drawback is avoided and an apparatus for carrying out the new process.

In the process according to the invention a tubular article to be worked is placed on a mandrel (or spindle) between keepers which are adapted to be fixed in position at the sides of the articles so as to prevent lateral displacement of the article and control its position.

The side of each keeper facing the article may extend at an obtuse angle to its own axis and to the axis of the mandrel.

During the rolling process the keepers press against the article. When the rollers are pressed against the article, the annular bulge provided on the rollers for the purpose of rolling the race will expand the article in the axial direction. This is seen most clearly when an inner race ring for ball bearings is rolled. In this case the operation of rolling the peripheral recess into the short tubular article to form the ball race track, first forces the material to extend laterally; in other words, the length of the tubular article is extended. As, however, the keepers which limit the position of the

article do not yield the material is thrust under the obtuse-angled lateral surfaces of the keepers. Thus the annular article becomes held so firmly as to provide a powerful obstacle in the way of enlargement of the bore.

The article or the unworked ring which may be a portion of a tube or the like can, in its pre-worked form, either be arranged to conform to the keepers in such a manner that the side surfaces of the ring before the rolling lie under those side surfaces of the keeper which extend at an obtuse angle to the axis of the spindle; it can, however, also be made so that a greater or lesser conformity to the shape of the keepers is first obtained by the laterally outward flow of the material displaced in consequence of the action of the rollers. Thus the unworked ring can be pre-worked, preferably so that its lateral surfaces form an obtuse angle with its peripheral surface, in such a manner that these lateral surfaces of the article bear entirely or partly against those lateral surfaces of keepers which face the article. It is, for instance, not absolutely necessary for carrying out the invention that such a ring should be clamped with its entire lateral surfaces between the keepers. In many cases this fact is particularly important where, for instance, it is required that the articles should undergo a further shaping process at their outer edge or edges, for example in the case of the inner rings of ball bearings. It is likewise possible, if desired, also to make considerable changes in the form of those parts of the article which extend radially beyond the keepers.

Instead of the side faces of the holders which face the article extending at an obtuse-angle to its axis, the keepers may also be bell-shaped while the side faces may be serrated or toothed.

In certain cases satisfactory results can be obtained with a single roller instead of two rollers. Although marked, i.e. not relatively superficial deformations of the peripheral surface of the article cannot be attained with the unilateral effect of one roller, in some cases it is nevertheless possible to effect the rolling more easily

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even when only a single roller is used.

The rolling process according to the invention and the apparatus serving for carrying out the process will now be further illustrated by way of example with reference to the accompanying drawings in which—

Fig. 1 shows a side view of a ball bearing race ring with the keepers shown in longitudinal section and showing the arrangement of the rollers when performing the rolling operation.

Fig. 2 shows an end view of the arrangement of Fig. 1, partly in section.

Fig. 3 shows the bell-shaped formation of the keepers at their sides facing the article to be worked.

Fig. 4 shows in longitudinal section an unrolled ring, while

Fig. 5 shows a side view of a ball-bearing ring the peripheral surface of which is completely rolled.

The article to be worked, i.e. the ball bearing ring *b* shown in Fig. 1, rests on the mandrel or spindle *a* the axis of which lies in the same plane as the axes *e* of the two rollers *d*. The keepers *c* which hold securely the ring *b* on the spindle *a* on both sides, are clearly shown in section in Fig. 1. The sides of the keepers *c* facing the ring *b* are hollowed, so that the upper side edge projects. In this manner, therefore, the side in question extends at an obtuse angle with the axis of the spindle *a*.

Now, when the two rollers *d* approach each other they meet the ring *b* and deform it at its peripheral surface. If, owing to the action of the annular bulge *f* of the roller *d* the material of the ring *b* flows in the axial direction, it is thrust under the obtuse-angled faces of the keepers *c*, while at the same time the keepers press obliquely inwards on the material against which they abut, so that it is no longer possible for enlargement of the bore of the ball bearing ring *b* to take place. When the rolling process is finished, the ring *b* may be removed from the spindle *a*, after the keeper or keepers have been loosened.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we

claim is:—

1. A method of manufacturing annular bodies, especially the race rings of anti-friction bearings, which comprises arranging a tubular article to be worked on a mandrel or spindle between keepers which are adapted to be fixed in position at the sides of the article so as to prevent lateral displacement of the article, the sides of the keepers which face the article being hollowed so as to receive material displaced laterally during the rolling operation or to receive laterally projecting or convex portions of the sides of the article and press against such portions during the rolling operation so as to oppose enlargement of the bore of the article.

2. A method as claimed in Claim 1 wherein the keepers are supported by the mandrel or spindle.

3. A method as claimed in Claim 1 or Claim 2 wherein the sides of the article make an obtuse angle with the peripheral surface.

4. Apparatus for carrying out the method claimed in Claim 1, 2 or 3 comprising keepers having side faces which extend at an obtuse-angle to the axis of a mandrel or spindle for supporting the article to be worked between the keepers.

5. Apparatus for carrying out the method claimed in Claim 1, 2 or 3 comprising keepers having sides which are hollowed out in a curved or bell-shaped fashion and adapted to be supported on opposite sides of a mandrel-supported article to be worked.

6. Apparatus for carrying out the method claimed in Claim 1, 2 or 3 comprising keepers having hollowed or inwardly inclined sides, these sides being serrated or toothed.

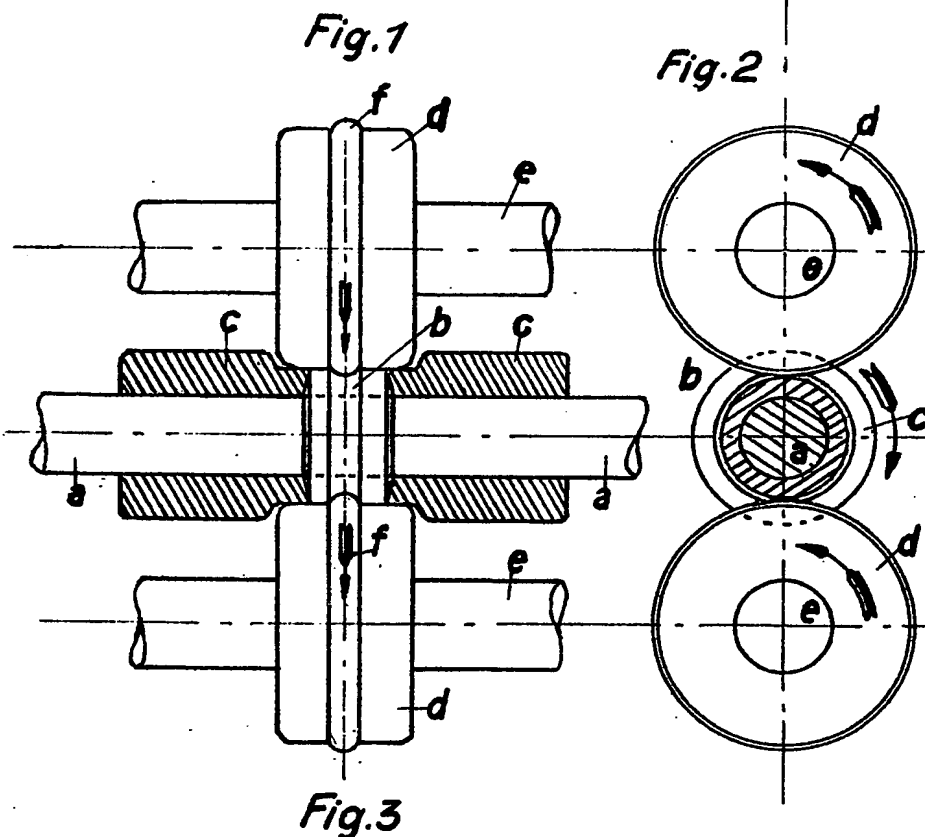
7. A method of rolling annular articles, substantially as described herein.

8. Apparatus for rolling annular articles, substantially as described with reference to the accompanying drawings.

Dated this 23rd day of January, 1939.

ABEL & IMRAY,
30, Southampton Buildings,
London, W.C.2,
Agents for the Applicants.

[This Drawing is a reproduction of the Original on a reduced scale.]



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